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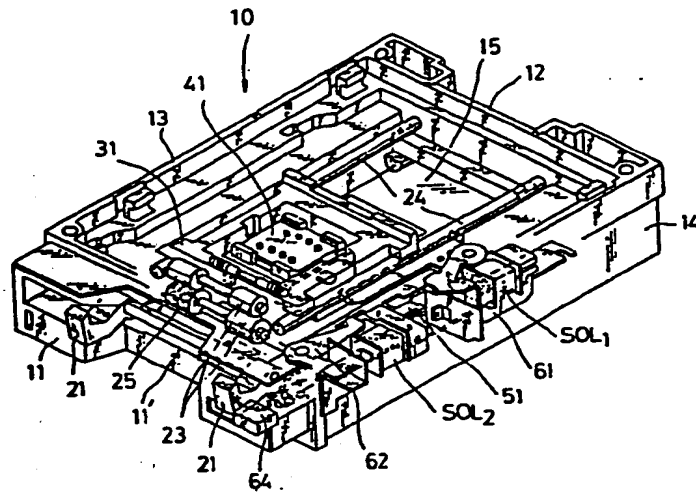
⑤④ Device for reading and writing IC card as external memory.

⑤⑦ A reader/writer for an IC card external memory comprises a carriage longitudinally movable in a casing (10) which is normally held in a waiting position in which the carriage (31) is held by spring means (25) and is moved to an operating position by manually inserting the card (C) engaging therewith against the spring force. A block member (41) having contact pins (42) is snugly embraced by the carriage (31) and is adapted to move vertically relative to the carriage to said operating position by sliding up an inclined floor (15') so as to establish electrical connection with card contact points. The IC card (c) is held by angularly movable hooks (21) actuated by lever means (51) to be moved by said carriage. Said hooks (21) are retracted by disengaging said lever means (51) from latching means (62'') and concurrently the carriage is returned to the initial position to eject the card out of the casing.

**EP 0 167 356 A2**

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Fig.1



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DEVICE FOR READING AND WRITING  
IC CARD AS EXTERNAL MEMORY

BACKGROUND OF THE INVENTION

5 The present invention relates to a device for reading stored informations out of and writing new informations in an IC card as external memory.

10 The so-called IC card, which has a plurality of contact points exposed to be flush with the surface of one side thereof and electrically connected with a memory and a central processing unit respectively embedded therein, has far more memory capacity in comparison with the magnetic card so that it is going  
15 to be widely used as identification card, credit card etc. instead of the conventional magnetic card.

The inventors have proposed such device having a pocket for the IC card to be angularly movable like as in a cassette tape recorder in US Patent Application  
20 No. 623736 filed on June 22, 1984 and European Patent Application No. 84304337.3 filed on June 26, 1984. When said pocket loaded with the card is angularly moved to be in the closed position, the contact points of the card may be engaged with the contact pins  
25 planted in the block member which is mounted on the casing via spring means so as to be yieldingly movable.

Said device must be mounted or placed, however, on the upper wall of the computer casing due to  
30 angular movement of said pocket, which may be disadvantageous from the view point of compactness.

The device having a stationary pocket in which

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the card is horizontally inserted has been actually used. Such device is not satisfactory, however, in that the card is sometimes slipped out of the pocket and the tail or trailing end of the card protruded out of the casing end wall may accidentally touched with something which may jeopardize electric connection of the card contact points with the contact pins in the device. When the external force affected on the card is strong, the card itself or the contact pins may be damaged. Furthermore, since the user of the IC card is often not familiar with computer operation, the card may too early be taken out of the device before or during the read/write operation by the computer.

## SUMMARY OF THE INVENTION

It is an object of the invention, thus, to provide a device for reading and writing an IC card as external memory, in which the card is horizontally inserted and held therein with partly exposing the trailing end portion thereof so as to visually confirm the loaded card but without fear of that said end portion is touched with anything for holding reliable electric connection of the card contact point with the contact pins in the device and consequently with the computer.

The other object is to provide such device having locking means for the IC card to be firmly held during the read/write operation and adapted to be disengaged from the card to be ejected out of the device when said operation is over.

The other objects and advantageous effects of the

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- invention will be readily appreciated by reading the detailed explanation to be given hereafter in respect of embodiments illustrated in the accompanying drawings.

5

## BRIEF EXPLANATION OF THE DRAWING

Fig. 1 is a perspective view of the first embodiment of the device according to the invention in  
10 which a lid is removed,

Fig. 2A is a side elevation of the above partly in section,

Fig. 2B is a plan view of the above partly in section,

15 Fig. 2C is a schematic view showing a first armature lever angularly moved by energization of a solenoid as well as concerned members, respectively in a larger scale,

Figs. 3A and 3B are views respectively similar to  
20 Figs. 2A and 2B but movable members are in operative positions,

Figs. 4A and 4B are side elevation partly in section of the front end portion of the device for showing a hook respectively in the retracted position  
25 and the locking position,

Fig. 5 is a block diagram showing how solenoid means is energized for actuating the longitudinal lever for moving said hook,

Figs. 6A and 6B are views respectively similar to  
30 Figs. 2A and 2B but of the second embodiment,

Figs. 7A and 7B are views respectively similar to Figs. 3A and 3B but of the second embodiment,

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Fig. 8 is a block diagram similar to Fig. 5 but of the second embodiment.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

In Figs. 1, 2A, 2B, 3A and 3B, a casing shown generally by 10 of the device according to the first embodiment consists of a front end wall 11, a back end wall 12, side walls 13, 14, a bottom wall 15 and a lid which is not shown. The front end wall 11 is recessed in the center part 11' so that a trailing end portion of the IC card C may partly be exposed there and formed with an inlet slit 11'' for the card C. As best shown in Fig. 2A by phantom lines, there are provided in the casing 10 at the vicinity of said end wall 11 a pair of locking hooks 21, 21 connected with a transverse rod 22 so as to be angularly movable together between the retracted position as shown in Figs. 2A, 2B and the locking position as shown in Figs. 3A, 3B, where the IC card C is firmly held at the trailing edge by the respective free ends thereof so that the card C can not be taken out nor slip out of the casing. At the vicinity of said inlet slit 11'' there are provided a pair of rolls 23 for guiding the card to be smoothly inserted in the casing.

A pair of bars 24, 24 are longitudinally mounted in the casing 10 for guiding a carriage 31 to be longitudinally movable, which is normally held in the waiting position as shown in Figs. 1, 2A and 2B by means of a coiled spring 25. Said carriage 31 is in the form of a rectangular frame having no top wall nor bottom wall so as to embrace a block member 41 snugly

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therein and above all with leaving a gap  $\int$  (Fig.2A) therebetween at the right in the drawing for the purpose to be explained later, which has a plurality of contact pins 42 (eight pins in the embodiment) planted at the top to be engaged with the contact points correspondingly arranged on the card C. Each of said contact pins 42 is preferably fitted in a vertical groove formed in the block member and provided with a coiled spring not shown at the root thereof so as to make good electric engagement with the counter part contact point of the card. The contact pins 42 are electrically connected with the computer (not shown) through a flat sleeve involving lead wires 42a, connectors 42b and 42b'. Said carriage 31 is provided with an upwardly protruded flange 32 at the leading end wall so that when the card C is manually inserted from the inlet slit 11'' in the casing the leading edge thereof may abut on said flange 32 to move the carriage 31 against the force of said spring 25 towards the operating position as shown in Figs. 3A, 3B along said guide bars 24, 24.

In order that the block member 41 may be stably vertically moved relative to the carriage 31, said member 41 is provided with a pair of trunnions 43 respectively on the side walls to be fitted in a pair of vertical grooves 33 formed in the inner walls of the opposite side frame members. For the same purpose, there is provided coiled springs 44, 44 respectively fixed at one end thereof on the carriage 31 so that the other end of each of said springs 44, 44 engages with the concerned trunnion 43 to resiliently urge the block member 41 downwards on the

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floor 15' of the bottom wall 15. These are provided a pair of rails 15', 15' sloped upwardly towards the back wall 12 (the right side in Figs. 2A, 2B, 3A and 3B) on the bottom wall 15 so that the block member 41 brought together with the carriage 31 to the operating position may slide over the sloped floor 15' to be moved up against the force of the springs 44 relative to the carriage 31 to be in the position as shown in Figs. 3A, 3B where the contact pins 42 may respectively engage the card contact points.

There is provided in the casing 10 further a longitudinally extended lever 51 in parallel to the guide bars 24 and consequently the carriage movement direction. Said lever 51 is formed with two slots 52, 52 to engage respectively with two headed pins 53, 53 fixed on the bottom wall 15 so as to be longitudinally movable between the positions shown in Fig. 2B and Fig. 3B and has one end connected with the hooks 21, 21 in such a way that when the lever 51 is moved from the position of Fig. 2B where said hooks 21, 21 are in the retracted position to the position of Fig. 3B, the hooks 21, 21 may be angularly moved to be in the locking position as shown in Figs. 3A, 3B.

As best shown in Figs. 4A, 4B, said one end of the longitudinal lever 51 has a pin 51' which is engaged with a slit 21' formed at the root of said hook 21. Thus, when said lever 51 is longitudinally moved from the position shown in Fig. 4A to the right in the drawings to occupy the position shown in Fig. 4B, the hook is angularly moved around the bar 22 to be in the locking position.

There is provided in the casing further an



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L-shaped slider lever 54 so as to be longitudinally moved from the position shown in Fig. 2B to the position shown in Fig. 3B when the carriage 31 is moved from the waiting position to the operating position by abutment of a protrusion (not shown) formed on the carriage on one end of the L-shaped lever 54. This slider lever 54 is normally held in the position of Fig. 2B by a coiled spring 55'. There is provided a ring spring 55 having opposite legs, one being engaged with said L-shaped lever 54 at the other end thereof while the other leg is engaged with the free end of said longitudinal lever 51.

Although said ring spring 55 serves to pull said two levers together in the position shown in Fig. 2B, when the L-shaped slider lever 54 is forcedly moved by the carriage 31 so that the point where the one leg of the ring spring 55 engages with the L-shaped lever has passed the point where the other leg of the spring engages with the longitudinal lever 51 a little, the ring spring 55 is snappingly turned by an angle of about 90° to take the position as shown in Fig. 3B where said spring serves to push the two levers apart with each other this time.

Owing to such function of the ring spring 55 connected with said two levers, when the carriage 31 is moved to be in the operating position by manually inserting the card C, said longitudinal lever 51 is snappingly moved from the position shown in Fig. 2B rightwards to be in the position of Fig. 3B so as to angularly move the hooks 21, 21 to firmly hold the card C at the trailing edge.

There are arranged two solenoids  $SOL_1$ ,  $SOL_2$  and

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respectively concerned armature levers 61, 62 at the vicinity of the longitudinal lever 51 in such a way that when said solenoid SOL<sub>1</sub> is energized (Fig. 2C) the concerned armature lever 61 is angularly moved  
5 against the force of a spring 61' to clear a latch 63 fixed thereto from a protrusion 51' of the longitudinal lever 51 so as to be made movable from the Fig. 2B position to the Fig. 3B position and that when said solenoid SOL<sub>2</sub> is energized the concerned armature  
10 lever 62 is angularly moved against the force of a spring 62' to disengage the other end 62'' thereof from a recess 51'' formed in the longitudinal lever 51 so as to be made movable from the Fig. 3B position to the Fig. 2B position.

15 Said solenoid SOL<sub>1</sub> is adapted to be momentarily energized when a sensor S<sub>1</sub> comprising light emitter and detector detects the position of the card C just before the completely inserted position in reply to a signal a as shown in Fig. 5. Said solenoid SOL<sub>2</sub> is  
20 adapted to be energized, as shown in Fig. 5, in reply to a command signal c from the CPU for instance when the device is installed for cash dispenser in the bank or combined command signals d from CPU and e from the key board for instance when the device is mounted on  
25 the personal or office computer.

A push button 64 is provided at the front end wall 11 normally held in the position as shown in Fig. 2B by a spring 65. Said button 64 has a rod 66 fixed thereto at one end so that the other end is located at  
30 the vicinity of said second armature lever 62 so that when manually pushing the button 64 against the force of the spring 65 the free end of said rod 66 may

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angularly move said armature lever 62 to disengage the other end 62'' thereof from the recess 51'' in the longitudinal lever 51 without energization of said solenoid  $SOL_2$ , which is necessary for instance when the card has been inserted in error, when electric power failure so that the computer cannot be operated or the solenoids cannot be energized or the like. Said rod 66 has a branched rod 67 of which free end is located at the vicinity of the armature lever 61 so that when the solenoid  $SOL_1$  is energized (Fig. 2C) to angularly move said armature lever 61 (Fig. 3B) the push button cannot be actuated due to the free end of said branched rod 67 abutting on said armature 61, which is necessary for avoiding too early taking out of the card before or during read/write operation.

Now in operation, the IC card C is inserted from the inlet slit 11'' so that the leading edge thereof abuts on the upwardly protruded flange 32 of the carriage 31 and moves said carriage toward the right in Figs. 2A and 2B against the force of the spring 25 so that the block member 41 is raised up relative to the carriage 31 by sliding on the sloped floor or rails 15', 15' as referred to above. This movement of the carriage moves the L-shaped lever 54 towards right in said drawings so that the ring spring 55 is turned by about 90° so as to cause a force on the longitudinal lever 51 to be moved leftwards in the drawings. Since the latch 63 fixed on the first armature lever 61 is still engaged with the protrusion 51' of the longitudinal lever 51 at the moment, however, said lever 51 cannot be moved.

When the further moved card C is detected by the

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sensor  $S_1$ , the first solenoid  $SOL_1$  is momentarily energized to disengage said latch 63 from the protrusion 51' so that the longitudinal lever 51 is snappingly moved by the force of said ring spring 55 to be in the position of Fig. 3B so as to angularly move the hooks 21, 21 to lock the card C now completely inserted at the trailing edge. The free end 62'' of the second armature lever 62 is engaged with the recess 51'' formed in said longitudinal lever 51 so as to keep said lever and consequently said hooks 21, 21 in the position as shown in Fig. 3A.

When fingers of the card user are removed from the trailing edge of the card completely inserted, the carriage 31 and the card C are together retreated owing to the force of the spring 25 by a distance corresponding to the space  $\delta$  (Fig. 2A) left between the card trailing edge and the hooks, but the block member 41 is not retreated due to the force of the springs 44, 44 pressing said block member downwards so that there is caused a relative movement between the block member and the card and consequently between the contact pins of the former and the contact points of the latter which cleans said contact members for good electric connection.

When the card C is completely inserted, this is detected by a second sensor  $S_2$ , the corresponding signal  $x$  (Fig. 5) is sent to the computer to commence read/write operation, during which the solenoid  $SOL_1$  is adapted to be energized in reply to the signal  $b$  (Fig. 5) to attract the armature of the lever 61 so that the button 64 cannot be pushed.

When the read/write operation is finished, the

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second solenoid  $SOL_2$  is adapted to be energized in reply to the signal c or combined signals d and e from the computer so as to disengage the free end 62'' of the armature lever 62 from the recess 51'' formed in the longitudinal lever 51 so that said levers 51 and 54 may be snappingly moved from the Fig. 3B position to the Fig. 2B position to retract the hooks 21, 21 owing to the springs 55 and 55'. At the same time, the spring 25 snappingly pulls the carriage 31 to the initial position whereby the card C leading edge of which abuts on the carriage flange 32 is ejected out of the casing.

Now, the second embodiment will be explained in reference to Figs. 6A, 6B, 7A, 7B and 8. Construction or arrangement and operation of the carriage, the block member, the longitudinally elongated lever and the hooks are fundamentally similar to those of the first embodiment so that the explanation shall be omitted so far as there is no essential difference. The same referential figures are given to the same members.

As best shown in Figs. 6A and 7A, the block member 41 has a protrusion 41' on the front (left in the drawing) wall and the carriage 31 has a corresponding recess 31' in the concerned wall so that when said block member 41 is raised up when the carriage 31 is brought in the operating position said protrusion 41' is engaged with said recess 31' to cause relative movement between said two members and consequently between the contact pins of the block member and the contact points of the card which is firmly kept on the carriage for self cleaning and good electrical

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connection. It is added that the upwardly protrusion 32 of the carriage 31 has a horizontally extended flange 32' so as to form a pocket for holding the leading end portion of the card C in this embodiment different from the first embodiment where the card is guided by the upper wall of the casing which causes friction more or less between the card and said upper wall.

As best shown in Figs. 6B and 7B, the longitudinally elongated lever 51 is not directly engaged with the hook 21 as in the first embodiment but has a link lever 51' in this embodiment therebetween of which one end is pivotally connected with the concerned end of said elongated lever 51 while the other end is pivotally connected with one of the hooks 21. There is no difference, however in the operation that when said elongated lever 51 is in the normal position as shown in Fig. 6B said hooks 21, 21 are in the retracted position, while when said lever 51 is moved by the carriage 31 to be in the second position as shown in Fig. 7B said hooks 21, 21 are brought in the locking position.

In this embodiment, there is provided only one pair of a solenoid  $SOL_3$  and a latch lever 61' having an armature at one end thereof to be attracted by said solenoid when energized. In the normal state as shown in Fig. 6B, the other end 61'' of said latch lever 61' is engaged with the elongated lever 51 at one side (right side in said drawings) of the protrusion 51''' formed therein so as to prevent said lever 51 from moving towards the position in Fig. 7B and consequently so as to keep the hooks 21, 21 in the retracted

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. position.

The slider lever 54' is connected with said elongated lever 51 not by the particular ring spring 55 as in the first embodiment but by a usual coiled spring 55'''. Owing to another coiled spring 55'' fixed to the casing at one end and to said slider lever 54' at the other end, the both levers are held together in the first position as shown in Fig. 6B. There is provided a protrusion 54'' on the slider lever 54' so as to engage with an opening 52' formed in the lever 51 for the purpose to be referred hereafter.

When the card C is inserted from the inlet slit 11' into the casing and consequently the carriage 31 is moved towards the operating position in Fig. 7B, the slider lever 54' is forcedly moved by said carriage 31 against the force of said springs 55'', 55''', but the elongated lever 51 is held still in the position of Fig. 6B since it is engaged with the latch lever 61'.

When the card C is completely inserted in the casing and consequently the carriage 31 arrives at the operating position, a projection 33 mounted at the leading end wall of the carriage is detected by a sensor  $S_3$  mounted at the back end wall 12 of the casing so as to energize the solenoid  $SOL_3$  for a moment to actuate the latch lever 61' against the force of a spring 62'' to clear said protrusion 51''' and allow the elongated lever to snappingly move owing to said spring 55'' towards the second position, whereby the hooks 21, 21 are snappingly brought in the locking position.

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Said latch lever 61' now engages at the end 61'' with said protrusion 51''' at the other side (left side in the drawings) so as to prevent the elongated lever 51 from moving back to the initial position and consequently so as to keep the hooks 21, 21 in the locking position.

When read/write operation is finished, said solenoid SOL<sub>3</sub> is adapted to be energized again in reply to a signal c or combined signals d and e from the computer as shown in Fig. 8 so that the other end 61'' of the latch lever 61' is disengaged from the protrusion 51''' of the elongated lever 51 to be made movable, whereby the lever 54' and the lever 51 engaged therewith by means of said protrusion 54'' and said opening 52' are returned to the initial position owing to said springs 55'', whereby the hooks 21, 21 are snappingly brought in the retracted position and concurrently the carriage 31 is snappingly pulled to be in the initial position for ejecting the card C out of the casing by means of said spring 25. When the solenoid SOL<sub>3</sub> is deenergized, the end 61'' of the armature lever 61' is engaged with the protrusion 51''' again at the right side in Fig. 6B.

When it is made necessary to manually take out the card from the casing, the button 64 is pushed against the force of the spring 65 like as in the preceding embodiment. In this embodiment, however, when the free end of the rod 66 fixed to said button 64 is detected by a sensor S<sub>4</sub>, the solenoid SOL<sub>3</sub> is adapted to be energized in reply to combination of a signal g from said sensor S<sub>4</sub> and said signal c from the computer not in read/write operation so as to



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- disengage the latch lever 61' from the protrusion 51''' of the elongated lever 51 to be returned to the first position so that the hooks 21, 21 are brought in the retracted position and at the same time the carriage 31 is returned to the initial position for ejecting the card C out of the casing as referred to above. When the solenoid SOL<sub>3</sub> can not be energized by any reason, e.g. power failure, the button 64 is further pushed on for instance by a pencil the free end of the rod 63 may mechanically actuate the latch lever 61' so as to realize a serie of movements just referred to above.

- It is finally added that the terms, "horizontally", "vertically" and the like have been used on the premise that the device according to the invention is mounted on the computer and the like in the illustrated position. The device, however, may be mounted in a plane normal to the horizontal plane or by any angle thereto as occasion demands, since various movements have no connection with the gravity. Said terms should correpondingly be understood in compliance with the device position.

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What is claimed is;

1. Device for reading and/or writing an IC card as external memory which has a plurality of contact points exposed to be flush with the surface of one side thereof, characterized by comprising a casing provided with an inlet slit for inserting said card formed at one end wall of said casing, a block member having a corresponding number of contact pins to be electrically connected with said contact points, and locking means adapted to be actuated when said IC card is fully inserted in said casing so that said electric connection may reliably be kept during said reading and/or writing.

2. Device as claimed in Claim 1 characterized in that said locking means is a pair of hooks arranged in the vicinity of said first end wall of the casing and adapted to be angularly moved together between a potential position where said hooks are retracted in the casing and a locking position where said hooks are exposed so as to engage with the trailing edge of the card completely inserted in the casing and that said end wall is recessed in the central part so that a trailing end parts of the card is partly exposed between the opposite side portions where said hooks are engaged with said card.

3. Device as claimed in Claim 1 characterized by further comprising a carriage arranged in said casing so as to be longitudinally movable together with said block member between a waiting position and

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- an operating position where the contact pins of said block member may be electrically connected with the contact points of the IC card fully inserted in the casing.

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4. Device as claimed in Claim 3 characterized in that said carriage is normally held in said waiting position by spring means and movable towards said operating position by manually pushing the IC card  
10 engaging therewith against the force of said spring means, said block member being so arranged as to be movable longitudinally together with said carriage and vertically relative thereto, whereby said contact  
15 points of the card completely inserted in the casing may be electrically connected with the contact pins of the block member vertically moved up relative to the carriage which is brought at said operating position.

5. Device as claimed in Claim 4 characterized  
20 in that said carriage is provided with a flange at the leading end thereof so as to be engaged with the leading edge of the IC card and so formed as to snugly embrace said block member which is vertically moved up  
relative to the carriage longitudinally moved by said  
25 card to be manually pushed along guide means towards said operating position by sliding on a sloped floor.

6. Device as claimed in Claim 5 characterized in that said flange has a vertical portion protruded  
30 from the upper wall of the carriage and a second portion extended parallel to said wall so as to form a pocket for receiving the leading end portion of the IC

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card.

7. Device as claimed in Claim 2 characterized by further comprising lever means which is engaged  
5 with said locking hooks and arranged so as to be longitudinally moved between a first position where said lever means is normally held by second spring means and by latching means engaging therewith so as to keep said locking hooks in said retracted position  
10 and a second position to where said lever means is forcedly moved against the force of said second spring means by said carriage moving towards said operating position, with momentarily clearing said engagement with said latching means owing to electromagnetic  
15 mechanism, so as to actuate said hooks to be in said locking position, said hooks being kept in said locking position owing to engagement of said lever means with said latching means.

20 8. Device as claimed in Claim 7 characterized in that said lever means comprises a longitudinally elongated lever engaged with at least one of said locking hooks at one end thereof and formed with slots to respectively engage with headed pins planted on the  
25 casing so as to be movable in parallel to the carriage movement direction by a distance defined by the slot length, and a slider lever connected with said elongated lever by third spring means so that said two levers are normally held in said first position  
30 together owing to said second and third spring means but when the slider lever is forcedly moved against said second spring means by said carriage moving

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- towards said operating position, the elongated lever is held for a while in the first position owing to the engagement with said latching means and by electro-magnetically clearing said engagement with the
- 6 latching means for a moment said elongated lever is snappingly moved to said second position owing to said third spring means.

9. Device as claimed in Claim 8 characterized  
10 in that said latch means comprises an angularly movable two-arm lever provided with an armature at one end and a solenoid so that when said solenoid is energized for a moment when the IC card is completely inserted in the casing and the reading and/or writing  
15 operation has been finished, said latch lever is angularly moved so as to disengage the other end thereof from the elongated lever to be made movable to either of said first and second positions.

20 10. Device as claimed in claim 8 characterized in that there are provided further a second latch lever and second solenoid so that said first solenoid is adapted to be energized when the IC card is going to be just completely inserted in the casing and said  
25 second solenoid is adapted to be energized after the reading and/or writing operation has been finished.

11. Device as claimed in Claim 9 characterized in that there is provided a button having a rod fixed  
30 thereto of which free end is normally held to be outside of a sensor by spring means so that when said button is manually pushed against the force of said

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. spring said rod free end is detected by said sensor so as to energize said solenoid and make the elongated lever movable to the first position, and when said button is further pushed the rod free end mechanically  
5 actuates said latch lever like as the solenoid attracts the armature of said latch lever.

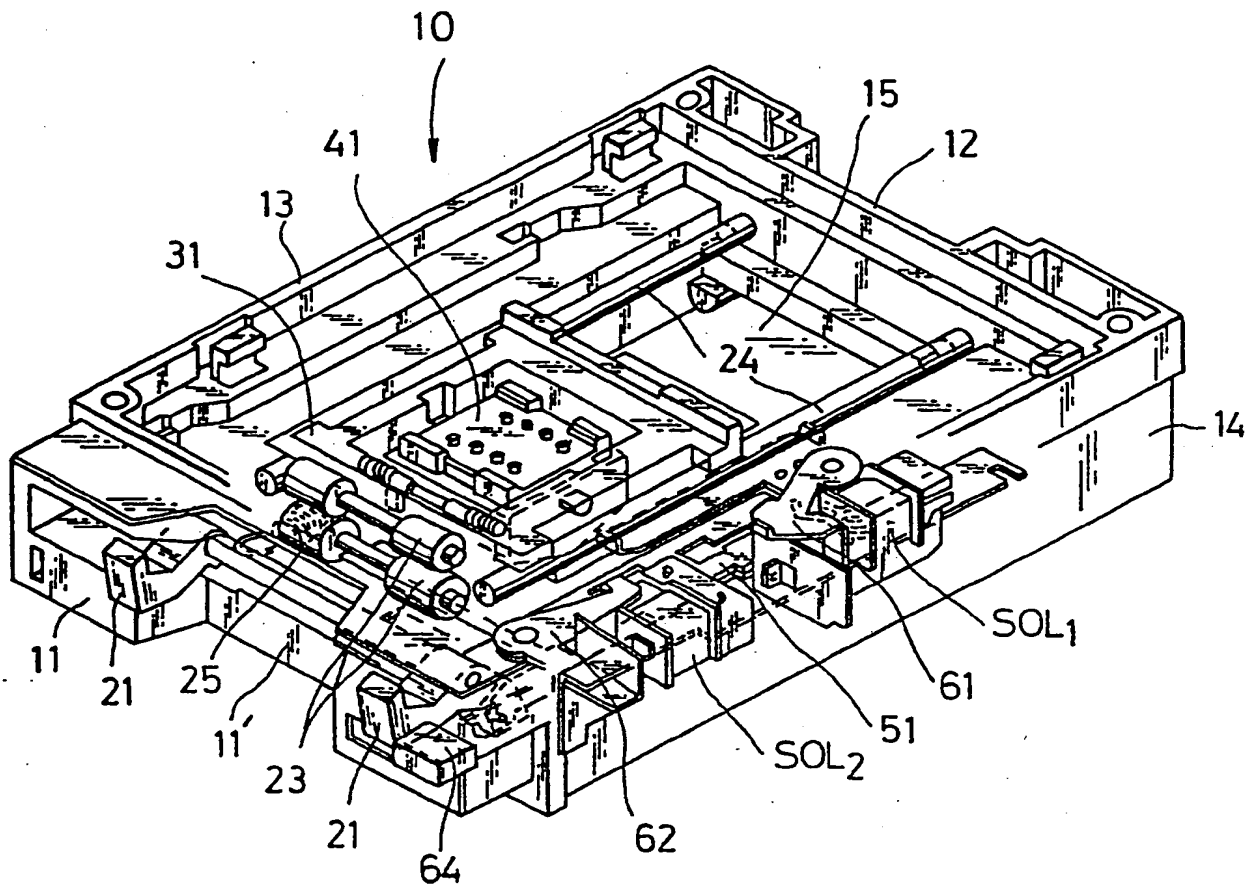
12. Device as claimed in Claim 10 characterized in that there is provided a button having a rod fixed  
10 thereto of which free end is normally held in the vicinity of said second latch lever by spring means so that when said button is manually pushed said rod free end mechanically actuates said second latch lever like as the concerned solenoid attracts the armature  
15 thereof, said rod having a branched extension of which free end is positioned just behind the first latch lever so that during reading and/or writing operation the latch lever of which armature is attracted by the energized solenoid is adapted not to allow pushing  
20 button by abutment of the free end of said branched extension on said lever.

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Fig.1



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Fig.2A

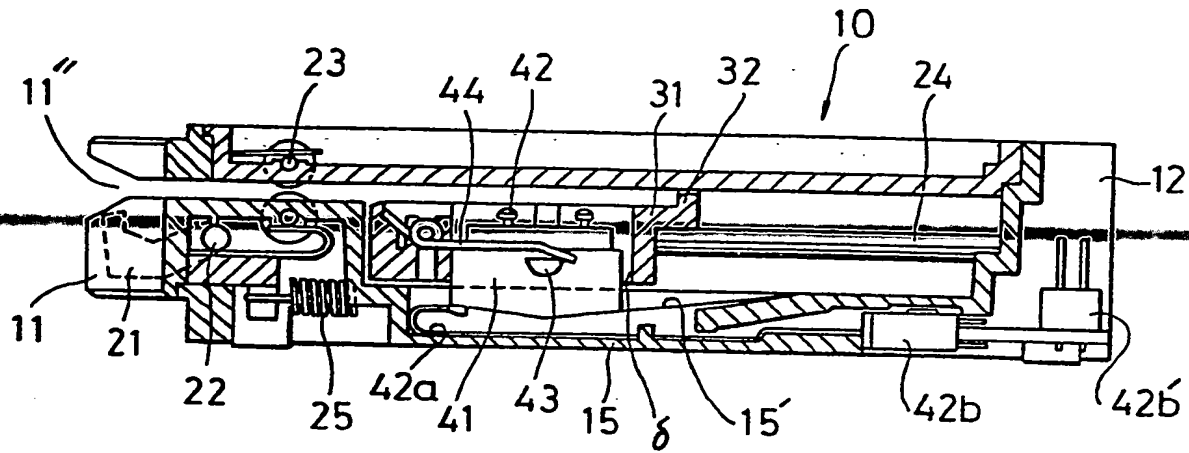


Fig.2B

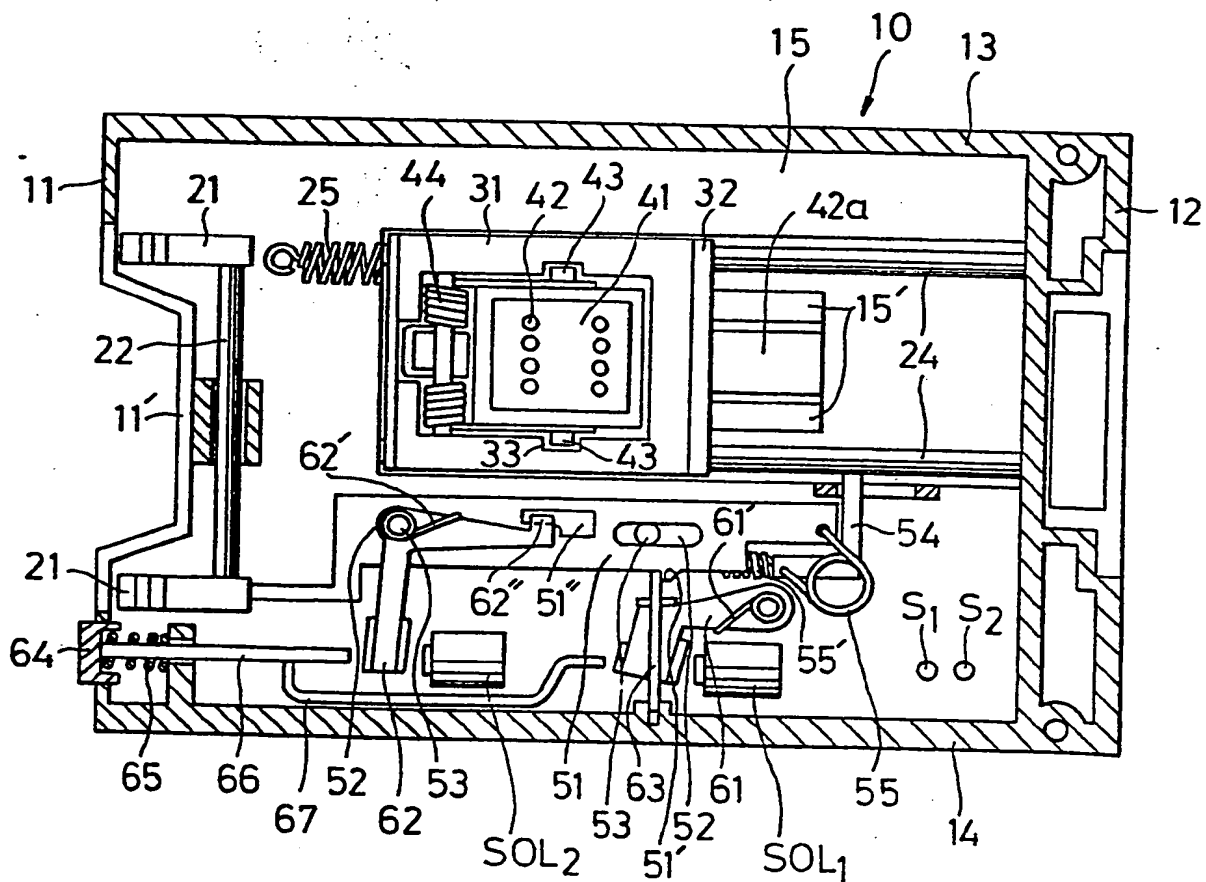




Fig.3A

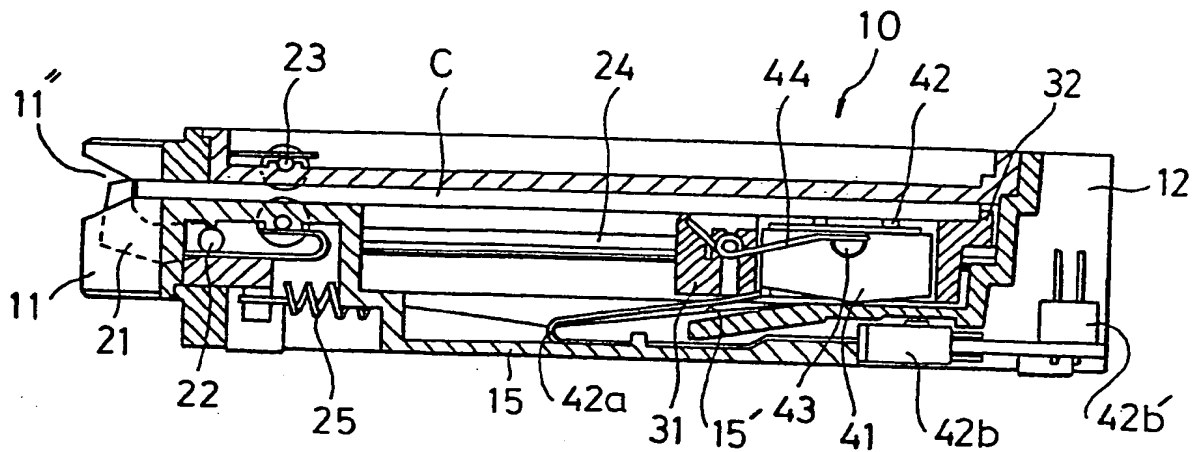
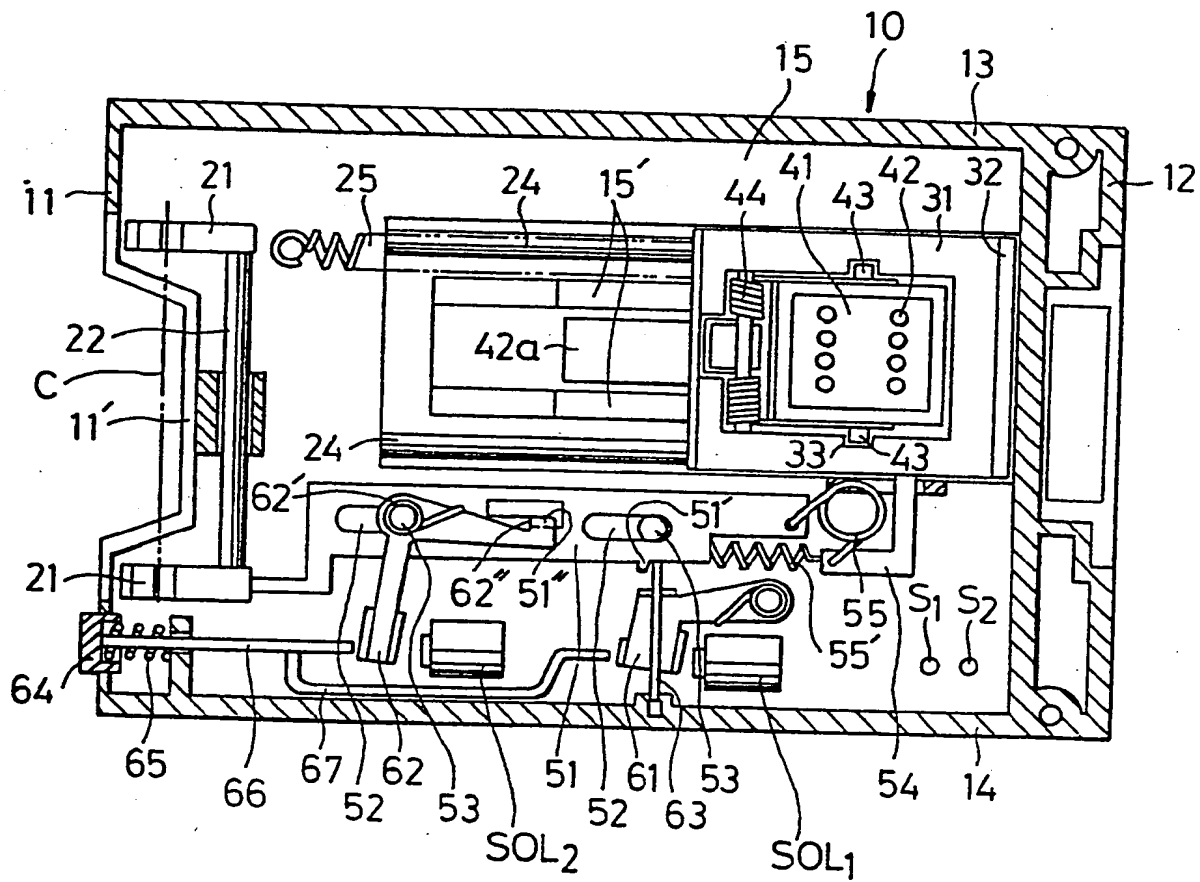


Fig.3B





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Fig.6A

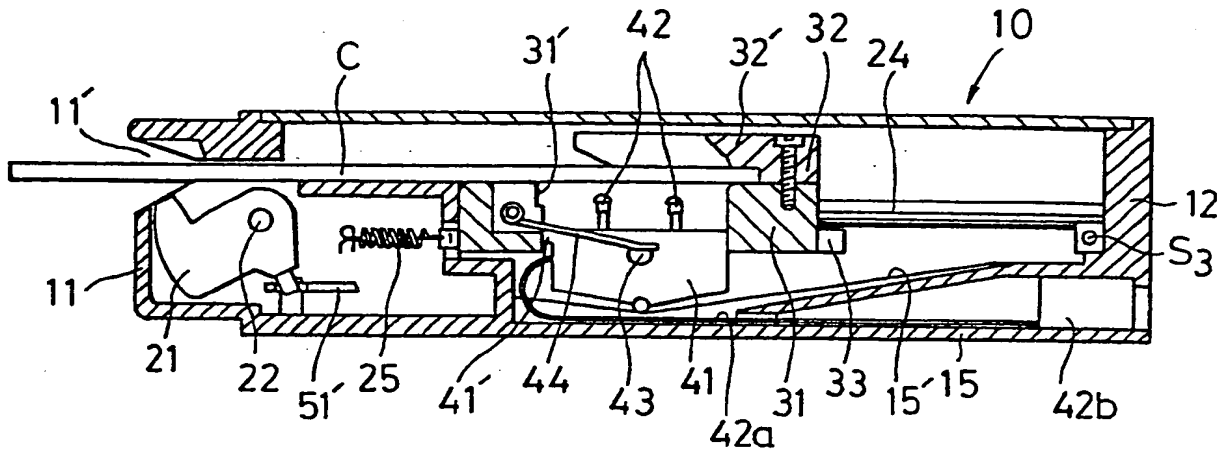
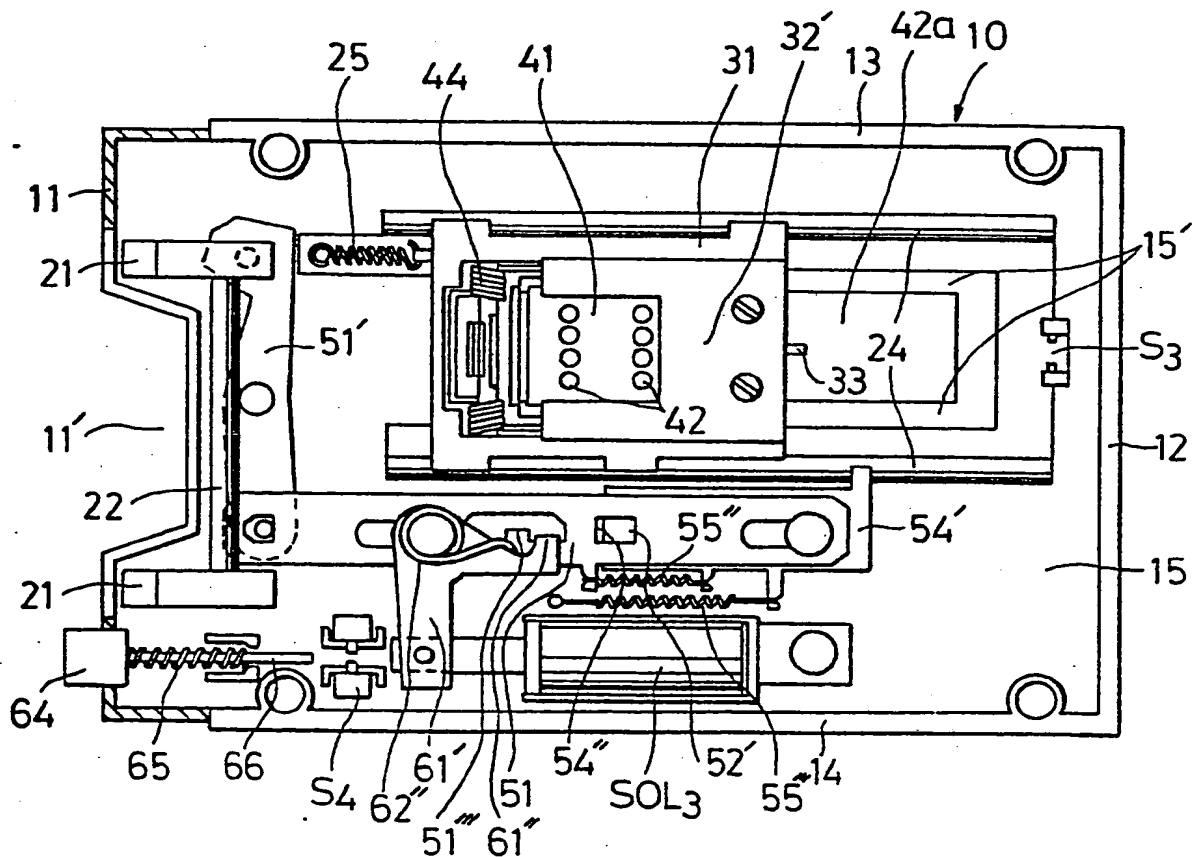
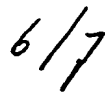


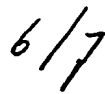
Fig.6B



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Fig. 8

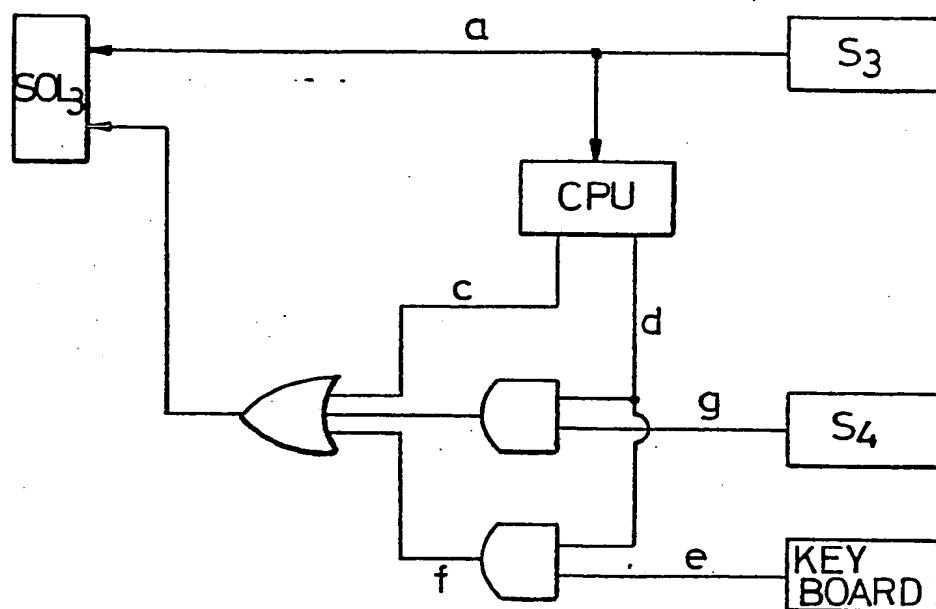
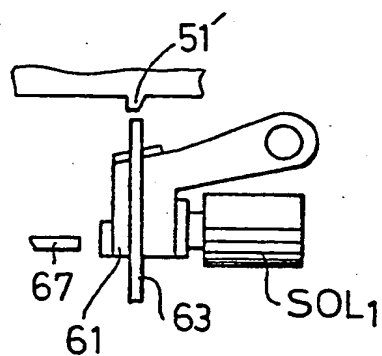


Fig. 2C



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